EVALUATION ON TH[illegible] J-TURN MOVEMENT

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ABSTRACT

Nowadays, people always want to move clearly to their destination. Many road and junction were upgraded especially in urban area because of the capacity of vehicles increase from time to time. So, it is important to monitor and analyse the road that can make congestion so that it can be improved by using traffic lights, roundabout, and the change of road geometry and so on. This study is referring to unsignalized junction, that is U-turn located at Batu 6 Federal Route Gambang-Kuantan, Kuantan Pahang near Kem Tentera Udara Malaysia (TUDM). Raff Method is the method used to analysed U-turn study area. By using the Raff method, critical gap and follow-up time of other vehicles can be identified study area. Data taken three times during the day in good weather conditions. After the traffic flow data and the U-turn geometry is taken, the data will be analysed using the Raff Method and critical gap at U-turn area is unknown. The results obtained showed that the gap time and time lag is really bad. In this study, the solution to this problem is proposed and one of the proposals is to replace the conventional U-turn with the modern U-turn.

ABSTRAK

Pada masakini, pergerakan yang lancar di atas jalanraya adalahsesuatu yang diperlukan olehsetiappengguna.Banyak jalan dan persimpangan yang telah diubahsuai atau dinaiktaraf terutamanya di kawasan Bandar kerana kapasiti kenderaan adalah meningkat dari semasa ke semasa. Jadi adalah sangat penting untuk memantau dan menganalisis kesesakan di jalanraya supaya ia dapat dipertingkatkan dengan menggunakan lampu isyarat, bulatan, perubahan geometri jalan dan lain-lain. Kajian ini adalah merujuk kepada persimpangan tanpa lampu isyarat, iaitu persimpangan-U yang terletak di Batu 6 JalanGambang-Kuantan, Kuantan Pahang berhampiran Kem Tentera Udara Malaysia(TUDM). Raff Method adalah kaedah yang digunakan untuk menganalisis persimpangan-U kawasan kajian. Dengan menggunakan Raff Method, jurang kritikal dan masa susulan kenderaan yang lain dapat dikenalpasti dikawasan kajian. Data diambil sebanyaktiga kali pada waktu siang dalam keadaan cuaca elok. Selepas data aliran trafik dan geometri kawasan persimpangan-U diambil, data akan dianalisis dengan mengunakan raff method dan jurang masa di persimpangan-U dapat diketahui. Keputusan daripada analisis menunjukkan jurang masa dan masa susulan adalah agak teruk. Dalamkajian ini, penyelesaian untuk masalah ini juga dicadangkan dan salah satu daripada cadangan tersebuta dalah dengan mengantikan persimpangan-U konvensional dengan persimpangan-U moden.

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LIST OF SYMBOLS

m	-	Width Of Median
l	-	Width Of U-Turn Lane
n	-	Width Of Median Barriers
a	-	Long Lane Stop
b	-	Length Of Lane Entry Ramp
c	-	Distance Skewed Trend
w	-	Width Of Median Between Two Lanes U-Turns

LIST OF ABBREVIATION

PWD	-	Public Work Department
IPD	-	Ibu Pejabat Daerah
AASHTO	-	American Association of State Highway Transportation Organization
AASHO	-	Association of State Highway Officials
RU	-	Rural Urban
UMP	-	Universiti Malaysia Pahang

CHAPTER 1

INTRODUCTION

1.1 Introduction

The road network is dependent on traffic at the intersection in the network especially in urban areas. By the study of the traffic at the junction is very important in the analysis of traffic. Important aspects in the study of traffic including vehicles speed, critical gaps and others.Junction is a place where the transfer of vehicles from the road to another route. In the process of changing the direction of movement of these vehicles, conflict will occur because the vehicle must pass other traffic stream which flows between it and its destination. Therefore, the design and traffic control at the intersection should be planned and carefully because it is closely related to traffic flow and safety of the public.Good intersection is the point of intersection that can reduce conflict and to facilitate the driver to change the direction of the vehicle. There are many types of traffic control at intersections that can be selected to enhance theoperational capability at a crossroads. Among them are traffic lights, construction of interchanges, the use of priority junctions and the use of the circle junction. Types of traffic control will be selected to be controls to reduce the queue lengths, critical gap, follow-up time and increase the capacity of the junction.

1.2 Background of Study Area

Case studies to be undertaken are to identify the limits of speed and critical gaps in two-way U-turn at Batu 9, near Air force Camp, Jalan Jaya Gading, Kuantan, Pahang. Major road to the U-turn is a Federal Route. The U-turn is a route for users from Kuantan and Gambang. Moreover near the study area there are facilities such as banks, post offices and business premises. The study area is the U-turn without traffic lights. Based on monitoring, we found at the U-turn using stop control for minor road to make way for major roads.

1.2.1 Location of Study Area

Figure 1.1(a) : U-turn from Kuantan

Figure 1.1(b):U-turn from Gambang

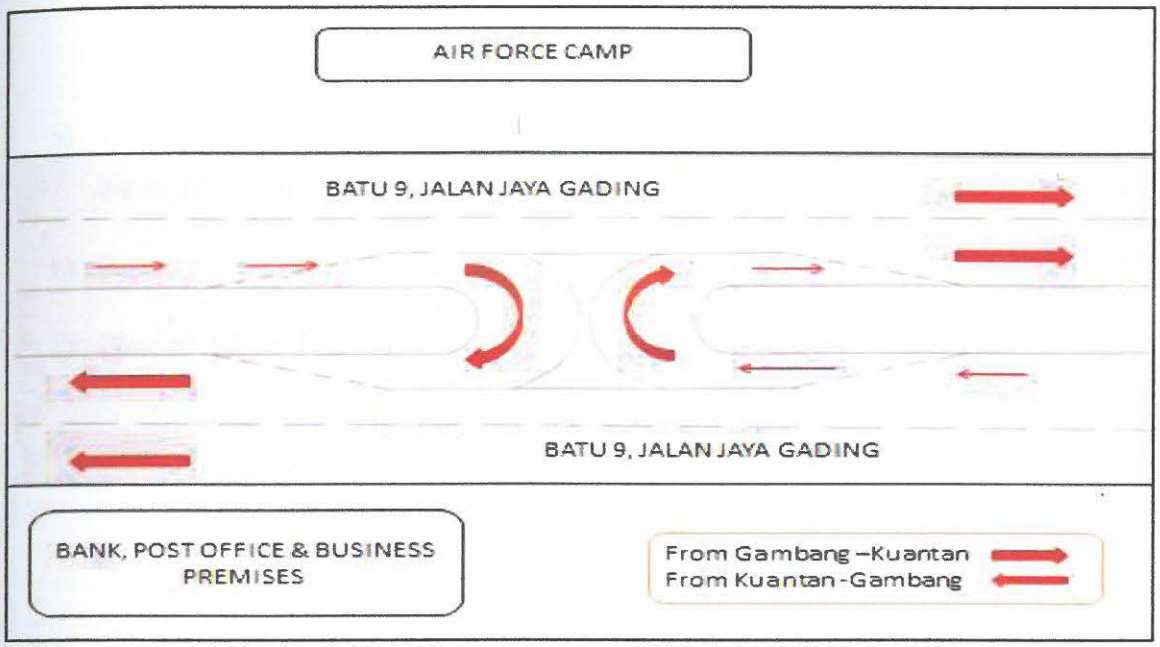

Figure 1.1(c): Sketch from plan of location

1.3 Problem Statement

Junction-U area is the main route and is a busy area because there are banks, clinics, restaurants and business premises. This route will usually crowd in the morning, afternoon and evening. Data obtained from the IPD (traffic), indicating an accident prone happened at U-turn area. Most of the U-turn area, roadway facilities and proper geometric design does not follow PWD standard. Nowadays the increased number of vehicles causing limited capacity of U-turning may result in congestion at U-turn area

1.4 Scope of Study

a) This study focuses on the vehicle make U-turn at multilane with a median in the middle of the road.

b) Focus only on car passenger.

c) Time to collect data

- Day –Other the day of Monday & Friday
- Time – Morning& Evening

1.5 Objective of Study

Objective of this study is to determine the level of service and safety in doing u turn movement on site. The following is an objective to achieve the above goals.

i. To determine the capacity of U-turn based on critical gap time.

ii. To obtain pattern of speed limit whether speeds are too high or speed too slow.

1.6 Expected Outcome

a) The critical gap at the U-turn area

b) The Level of Service of the intersection

c) Maximum and minimum speed of vehicles through the junction U

CHAPTER 2

LITERATURE REVIEW

2.1 Introduction

Movement is the backbone system to human activities. It's very important network to carry out the activities with various location and to bring people and goods through the growing network at the same time in line with the growth of an increasing complex society. The movement depends on the existence of adequate transport and transport requires road networking such as smooth, good and systematic. A good network system not only can accommodate volume of traffic capacity flow in one time, but can give a minimum delay to driver. Based on previous studies (Xiao et al. Al, 2004), the driver is more concerned with faster journey times than other things. Delay is the main thing is always avoided by the driver. Changes in road management systems mostly done to minimize the delay which must be received by the driver, but there is also a preferred system change over delay in road capacity, particularly in urban areas to accommodate the traffic volume is high. Changes in system should be reviewed to avoid wastage effectiveness not only on time but also on the cost of fuel and travel distance to be passed by the driver. Traffic management required to control road users

for get in maximum from the road network system existing in place for the benefit of all users. Maximum use will lead to higher traffic volumes without delay and to be safe for use.

2.2 U-turn

A U-turn in driving refers to performing a 180 degree rotation to reverse the direction of travel. It is called a "U-turn" because the maneuverer looks like the letter U. In some areas, the maneuverer is illegal, while in others it is treated as a more ordinary turn, merely extended. Consequently, vehicles making U turns may have. Slower turning speeds. At median openings, drivers usually need larger gaps in the major street traffic stream to make U turns. Arguments have been advanced by some opponents of median modification projects that median openings may not be able to handle large numbers of U-turning vehicles due to the limited capacity of U-turn movement, and the increased number of U turns may result in traffic congestion at median openings.There has been little documentation on the operational effects of U-turns, which contains procedures and models for estimating capacity and delay for different movements at unsignalized intersections, does not provide specific guidelines for estimating capacity and delay of U-turns at median openings. Traffic operations at U-turn median openings have not yet been formallyaddressed (2000 HCM).Developed regression equations to estimate the delay and capacity of U-turns by field experiment. The empirical formulas indicate that there are strong correlations among the delay, capacity and total conflicting traffic flow. U-turns at median openings can only be made in the gaps between platoons during peak traffic periods. Nothing occurs while the platoons pass side streets and U-turn median openings. It was found that delays of U-turn vehicles making a right turn from upstream side streets have a strong correlation with the offset of upstream and downstream signal timing, weaving length, the length between the side street and upstream signal, and signal spacing (Hashem R. Al-Masaeid) .

2.2.1 Dimension of U-turn

Dimension is a key measure that produces comfort and safety of road users. This is because if the dimensions not follow specification, the dimensions need to be changed. Changes made necessary by requirements of the current situation can cause problems. But the question is, does this change can reduce congestion, delay and rate of road accidents. In this study, aspects of the review are in the technical aspects, safety, speed limits and critical gaps. This is because all these aspects interconnected with each other. If the less technical aspects taken into account, this will increase to aspects of the accident.

2.2.2 Design Factors U-turn

a) Geometry
b) Location
c) Dimension
d) Types of U-turn and movement
e) Characteristics of traffic
f) Placement of U-turns

2.2.3 Design Considerations U-turn

Vehicle doing U-turns that disrupt the flow of traffic in the mainroute by reaching in on a portion or all lanes of traffic. It is done at low speed and speed changes are usually done in the lane of traffic continues to intervene in or out of the outer lane. U-turns due to facilities is an area of potential danger, careful consideration needs to be done not only on need but also on the type and location of U-turns. According to ArahanTeknik (Jalan)8/86 by the Public Works Department (PWD, 1986), there are two types of U-turns are widely used in Malaysia, U-turns lane directly and U-turns lanes

indirectly. U-turns design is very similar to the design described by the American Association of State Highway Officials (AASHO) and the American Association of State Highway Transportation Organization (AASHTO). Below are described the types of U-turns are used in Malaysia.

2.2.3.1 Direct U-turn

Types of direct U-turn are most popular in Malaysia. Layout should be provided for these U-turns are simple and give the minimum of delay. But U-turns are less suitable for long due to the radial trailer lane limited U-turns. This type of U-turns can be modified by the addition of pavement, and this will increase the radius for U-turns. There are two categories for U-turns this kind of U-turns are high speed and low speed U-turns. For U-turns direct, road widths, including the median, should be sufficient to allow rotation without reaching beyond the outer side of the road pavement. Figure 2.1 shows the minimum width required for the various types of motion in a direct U-turns. For this type of U-turns, layout in Figure 2.1 and 2.2 are proposed andminimum width and spacing for each dimension that can be used are given in Table 2.1 (PWD, 1986). If U-turns are not suitable due to the limitations median, U-turns are not directly used. Below are described the characteristics of U-turns are high speed and low speed U-turns.

i. Characteristics of High Speed U-Turn: -

   a. Surface area is a single median

   b. Speed zones of less than 80 km / h

   c. Traffic flow is less than 1000 veh / hr.

   d. Vehicle visibility to the contrary is clear and more than 140 meters

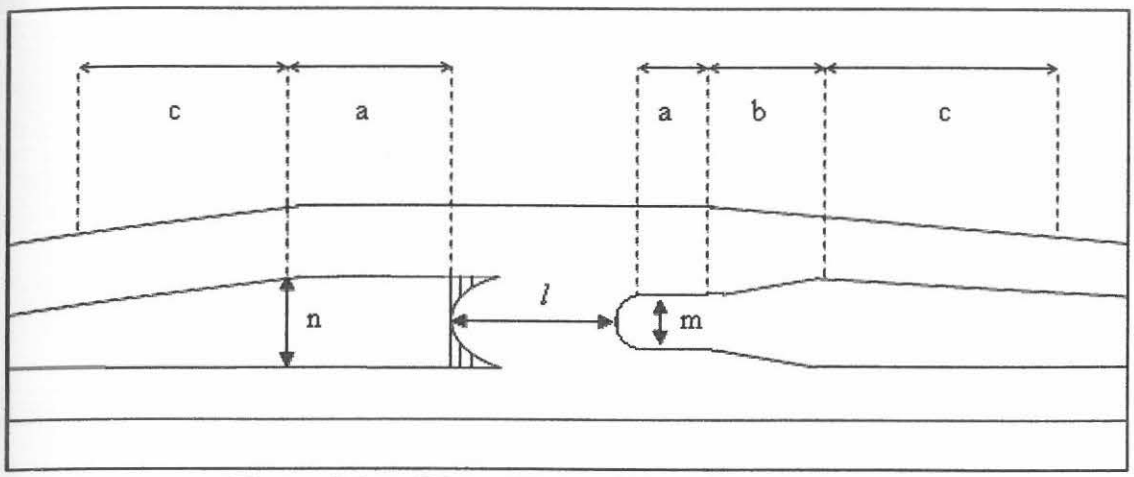

Figure 2.1 Direct U-turn: High speed

Where,

m=width of median

l=width of U-turn lane

n=width of median barriers

a=long lane stop

b=length of lane entry ramp

c=distance skewed trend

TABLE 2.1 Minimum width and spacing for each dimension

Dimension	Minimum width/distance (m)
A	20
B	60
C	120
L	7.5
M	10.0
N	17.0

ii. Characteristics of Low-Speed U-Turn: -

a. Median opening dual space of both the traffic stream

b. Speed zones of less than 60 km / h

c. Traffic flow more than 1000 veh / hr.

d. Opposing vehicle visibility is less critical with a minimum distance of 80 meters

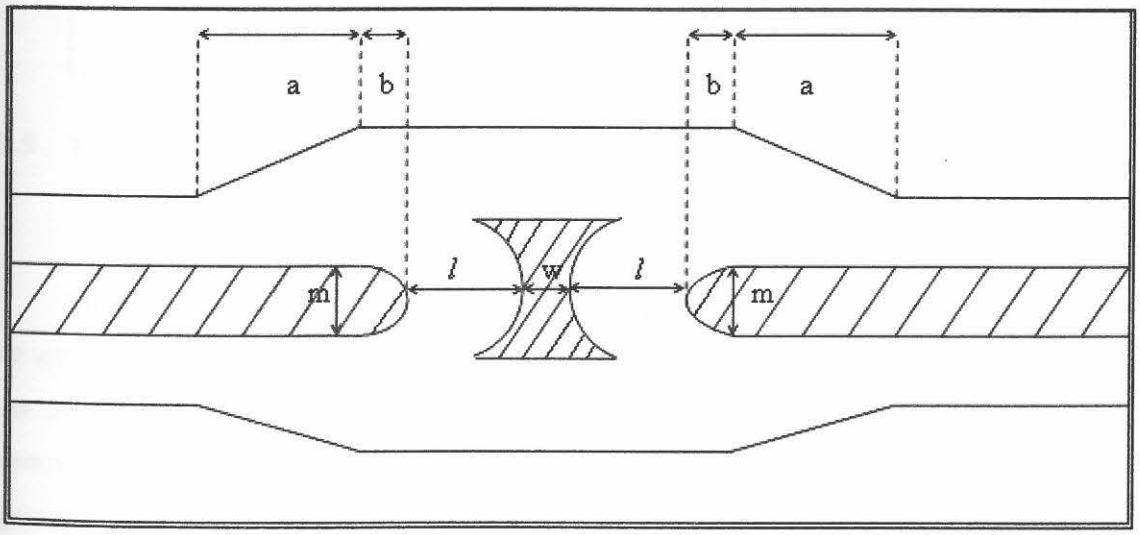

Figure 2.2 Direct U-turn: Low speed

Where,

a, b, l and m as shown in Figure 2.1, and

w = width of median between two lanes U-turns

2.2.4 Location of U-turn

Location for U-turns is very important and good judgment should be given. As a general rule, Table 2.2 can be used to obtain minimum distance between each U-turn (Arahan Teknik (Jalan) 8/86).

Table 2.2 The Distance Between of U-turns

Reka bentuk Piawai	Jarak di antara Pusingan-U	Reka bentuk Piawai	Jarak di antara Pusingan-U
R6	Pusingan-U tidak dibenarkan	U6	Pusingan-U tidak dibenarkan
R5	3 km	U5	2 km
R4	2 km	U4	1 km
		U3	0.5 km

2.2.5 The types of maneuvering at U-turn

Maneuvering is a vehicle movement patterns are being stopped in the U-turns lane until the vehicle can move together with the opposite flow of traffic. In Malaysia, there are three types of maneuvering common as indicated by the JKR and all this maneuvering have advantages and disadvantages of each. Figure 2.3 and Table 2.3 shows the types with a minimum wide maneuver median required by some types of vehicle mode for geometric design purposes of U-turns lanes.

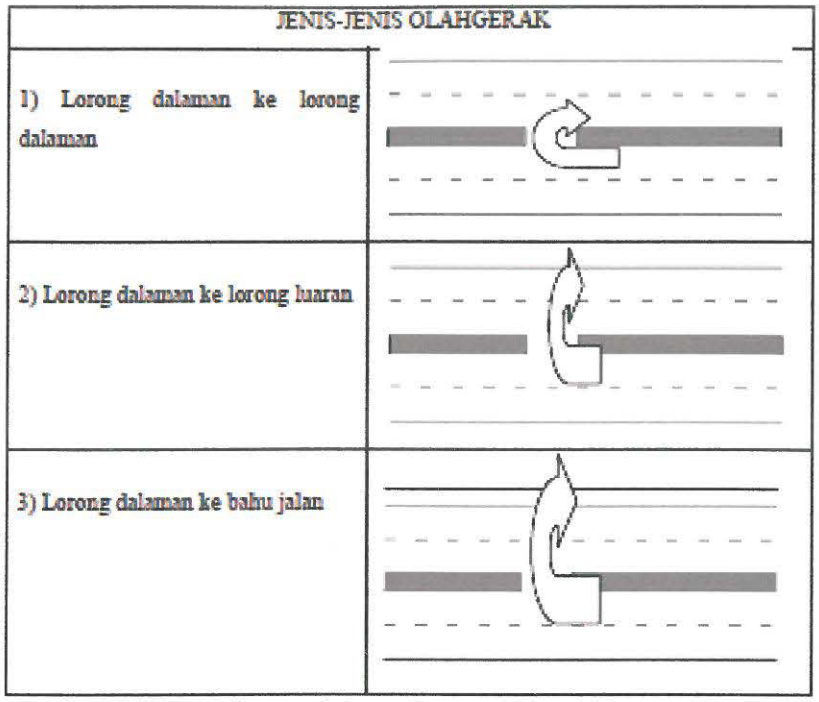

Figure 2.3 Types of Maneuverer

Table 2.3 Minimum Wide Maneuver Median

JENIS KENDERAAN	LEBAR MINIMUM (m)		
	JENIS 1	JENIS 2	JENIS 3
P	9.75	6.00	3.00
SU	19.50	15.75	12.75
WB-50	21.25	17.75	14.50

dengan. P = kenderaan persendirian
SU = unit trak
WB-50 = semi-treler

2.2.6 The pattern of 'Weaving' at U-turn

According to a study conducted by the National Cooperative Highway Research Program (Zhou et al. Al, 2002), there are three types of patterns for Weaving:

a. When weaving distance is short (i.e., 75-150 meters (250-500 feet), less than a rightturn deceleration lanes on major roads),many drivers will choose the appropriate intervals simultaneously to enter all the streets and make a direct entry into the lane right-turn deceleration.

b. Weaving is the medium of distance (i.e., 150-305 meters (500 to 1.000 feet), not enough to make changes lane with ease), most drivers will choose intervals appropriate to the simultaneous enter all the streets and make a direct entry into the lane most of.

c. When Weaving distance is long (i.e.,> 305 meters (1,000 feet)), the driver will choose an appropriate interval, enter the left-side lane, speeding with appropriate speed, and then make a change lanes to right into the lane.

2.3 Delay

There are several types of traffic delay, the control delay, vehicle interaction delay, and geometry delay and so on. Delay of interaction was due to drive vehicles that are less than free flow speed due interaction with nearby vehicles. Geometric delay was caused by driving less than free flow speed due to the geometric design of roads. Control is also because of situation a controlled and exclusive mutually with interaction of delay and geometry delay. In general, the control delay is the sum of the sources of delay and the delay of this type will be lost if the traffic signal changed from the junction (TRB 2000). Delay time depends on the rate of traffic flow and capacity that can be borne by the road. It is defined as the time lost due to friction of traffic and traffic control devices. TRB (1994) formulate the delay time occurs when a minimum volume of right turning vehicles more than two vehicles per cycle during the peak and average delay time experienced by each vehicle is turning right more than 35 seconds. Time delay problem is not only causing environmental impact, but also has an impact on the next intersection. Research carried out as indicator for level of services provided, also the effectiveness and efficiency of the flow at some road. The research data delay time was needed to assess the amount of congestion, congestion status and the factors happened of congestion occurrence to determine the improvement efforts.In addition a result from research of the delay time can serve as a resource for the study of the timing of traffic lights. In addition, these data are used as data for the study before and after, especially to determine the effectiveness of the reforms carried out like a change in timing traffic lights, two-way street into a one-way street, and so on. This data is also